DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Food and Drug Administration
9200 Corporate Boulevard
Rockville MD 20850

SEP 10 2004

Mr. Michael G. Stabin, Ph.D., CHP
Assistant Professor of Radiology and Radiological Sciences
Vanderbilt University
1161 21st Avenue South
NASHVILLE TN 37232-2675

Re: K033960
Trade/Device Name: OLINDA EXM
Regulation Number: 21 CFR 892.1100
Regulation Name: Scintillation (gamma) camera
Regulatory Class: I
Product Code: 90 IYX
Dated: May 19, 2004
Received: May 20, 2004

Dear Dr. Stabin:

This letter corrects our substantially equivalent letter of June 15, 2004 regarding the typo for the incorrect regulatory class. The June 15th letter stated this device as class II instead of class I.

We have reviewed your Section 510(k) premarket notification of intent to market the device referenced above and have determined the device is substantially equivalent (for the indications for use stated in the enclosure) to legally marketed predicate devices marketed in interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments or to devices that have been reclassified in accordance with the provisions of the Federal Food, Drug, and Cosmetic Act (Act) that do not require approval of a premarket approval (PMA). You may, therefore, market the device, subject to the general controls provisions of the Act. The general controls provisions of the Act include requirements for annual registration, listing of devices, good manufacturing practice, labeling, and prohibitions against misbranding and adulteration.

If your device is classified (see above) into either class II (Special Controls) or class III (PMA), it may be subject to additional controls. Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Parts 800 to 898. In addition, FDA may publish further announcements concerning your device in the Federal Register.

Please be advised that FDA's issuance of a substantial equivalence determination does not mean that FDA has made a determination that your device complies with other requirements of the Act or any Federal statutes and regulations administered by other Federal agencies. You must comply with all the Act's requirements, including, but not limited to: registration and listing (21 CFR Part 807); labeling (21 CFR Part 801); good manufacturing practice requirements as set

forth in the quality systems (QS) regulation (21 CFR Part 820); and if applicable, the electronic product radiation control provisions (sections 531-542 of the Act); 21 CFR 1000-1050.

This letter will allow you to begin marketing your device as described in your Section 510(k) premarket notification. The FDA finding of substantial equivalence of your device to a legally marketed predicate device results in a classification for your device and thus, permits your device to proceed to the market.

If you desire specific advice for your device on our labeling regulation (21 CFR Part 801), please contact the Office of Compliance at one of the following numbers, based on the regulation number at the top of the letter:

8xx.1xxx	(301) 594-4591
876.2xxx, 3xxx, 4xxx, 5xxx	(301) 594-4616
884.2xxx, 3xxx, 4xxx, 5xxx, 6xxx	(301) 594-4616
892.2xxx, 3xxx, 4xxx, 5xxx	(301) 594-4654
Other	(301) 594-4692

Additionally, for questions on the promotion and advertising of your device, please contact the Office of Compliance at (301) 594-4639. Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR Part 807.97) you may obtain. Other general information on your responsibilities under the Act may be obtained from the Division of Small Manufacturers, International and Consumer Assistance at its toll-free number (800) 638-2041 or (301) 443-6597 or at its Internet address http://www.fda.gov/cdrh/dsma/dsmamain.html.

Sincerely yours,

for Nancy C. Brogdon
Director, Division of Reproductive,
Abdominal, and Radiological Devices
Office of Device Evaluation
Center for Devices and Radiological Health

Enclosure

510(k) Number (if known): K033960

Device Name: Olinda EXM

Indications For Use: The purpose of Olinda EXM is to estimate the radiation dose received by internal organs as a result of administering a radiopharmaceutical.

(PLEASE DO NOT WRITE BELOW THIS LINE - CONTINUE ON ANOTHER PAGE IF NEEDED)

Concurrence of CDRH, Office of Device Evaluation (ODE)

Prescription Use ✓ OR Over-The-Counter Use_____
(Per 21 CFR 801.109)

(Optional Format 1-2-96)

David A. Lazzara

(Division Sign-Off)
Division of Reproductive, Abdominal,
and Radiological Devices
510(k) Number K033960

K033960

JUN 1 5 2004

510(k) Summary

Applicants name address, phone and fax:
Vanderbilt University

Contact persons name and address:
Michael Stabin
Vanderbilt University
1161 21st Avenue South
Nashville, TN 37232-2675

Telephone / Fax number of contact:
(615) 343-0068 / (615) 322-3764

Date Summary prepared:

Trade Name: OLINDA/EXM
Common Name: Organ Level INternal Dose Assessment/EXponential Modeling
Classification: Not yet classified
Devices OLINDA/EXM is substantially equivalent to: CDI3, Computer Program for Tissue Doses in Diagnostic Radiology, distributed by the Food and Drug Administration. CAMIRD, distributed by the Biomedical Computing Technology Information Center, Oak Ridge National Laboratory, PO Box X, Oak Ridge TN 37830.

Description of OLINDA/EXM:

The personal computer code OLINDA, which is an acronym standing for Organ Level INternal Dose Assessment/EXponential Modeling, calculates radiation doses to different organs of the body from radiopharmaceuticals which are administered systemically (mostly intravenously, but sometimes by oral or inhalation intake routes).

The code requires input from the user on:

1) Which radionuclide is to be used,
2) A choice of body model(s) to represent the subject(s) of interest - models exist for adult males, adult females, children, and women at different stages of pregnancy, and a number of individual organ systems (not included in the body phantoms).
3) Parameters which describe the biokinetics of the radiopharmaceutical within different organs of the body with time. Specifically, a potential user needs to provide the time integral of activity in all important source organs of the body. Alternatively, the user may provide biokinetic data and the EXM portion of the code will fit these data to a model, calculate the necessary integrals, and pass them to the OLINDA portion.

The code works in the Windows 2000 or Windows XP Professional operating environments.

Intended Use of Olinda EXM: The purpose of OLINDA/EXM is to estimate radiation doses received by internal organs as a result of administering a radiopharmaceutical.

Comparison to CAMIRD

This program was legally distributed by the Biomedical Computing Technology Information Center, Oak Ridge National Laboratory, PO Box X, Oak Ridge TN 37830 in April 1976. It was described in a paper by Feller (1976), a copy of which is attached. It has been used by others and is referred to in a paper by Bellina and Guzzardi (1980). It is a pre-amendment device. It has not been through a 510(k) process and does not have a document control number. It has not been classified. Three versions of CAMIRD were written. The comparison here is to version II.

Comparison	CAMIRD	OLINDA/EXM	Discussion
Indications for use	Estimates the absorbed doses to several tissues of a reference patient for a specified radiopharmaceutical dosage	Estimates the absorbed doses to several tissues of a reference patient for a specified radiopharmaceutical dosage.	Equivalent. Both calculate dose per unit input.
Target population	Specific patients and patient groups not targeted. Calculations are based on models of an average individual (reference adult male).	Specific patients and patient groups not targeted. Calculations are based on models of average individuals. 10 models are available e.g. adult male, female, 5 year-old, 6-month pregnant woman.	Target population equivalent. OLINDA/EXM has a larger number of phantoms.
Design	User specified radiopharmaceutical kinetic parameters and previous Monte Carlo calculated organ contributions. Algorithm: MIRD method (Loevinger et al. 1988)	User specified radiopharmaceutical kinetic parameters and previous Monte Carlo calculated organ contributions. Algorithm: MIRD method (Loevinger et al. 1988)	The programs are essentially equivalent in input and output. The main difference is in the number of body models available.

	Input: 1. Radionuclide 6. Body model 7. Radiopharmaceutical biokinetics	Input: 1. Radionuclide 2. Body model 3. Radiopharmaceutical biokinetics	
Energy used and/or delivered	The program estimates doses from user-entered criteria and precalculated data; it is not connected to an energy-emitting device.	The program estimates doses from user-entered criteria and precalculated data; it is not connected to an energy-emitting device.	Equivalent
Performance	Output of dose per unit input. Simpler system than OLINDA/EXM. Fortran IV, input driven program. Only 1 body phantom, fewer organs in output.	Output of dose per unit input. User friendly, event driven, more body phantoms, more organs in output.	OLINDA/EXM is equivalent in performance to CAMIRD.
Human Factors	A descriptive paper is available in the open literature.	Communication tools for error prevention have been systematically implemented. Error messages, help files, user manual and installation tests have all been developed so as to educate the user and prevent mistakes. An open literature publication is in preparation describing the OLINDA/EXM code. An open literature publication is available describing the MIRDOSE code (Stabin 1996), on which the OLINDA/EXM code was based.	OLINDA/EXM is more user-friendly.
Anatomical sites	Program Tissue doses calculated: Adrenals, Fat, Blood, ovaries, Skin, Uterus, Lower Large Intestine, Small Intestine, Stomach,	Tissue doses calculated: Adrenals, Brain, Gall Bladder Wall, Gall Bladder Cont, Lower Large Intestine Wall, Lower Large Intestine	More tissues included in OLINDA/EXM.

dose factors are based have been established previously in the literature (Cristy and Eckerman 1987, Stabin et al. 1995) and have been widely accepted and used by the international dosimetry community. Both programs are limited in that they use average body models and thus are not representative of any particular patient. OLINDA/EXM has more body models to choose from and also permits the user to vary the mass of individual organs to provide a limited measure of patient-specificity. Both programs are intended to be used by trained physicists or appropriately trained physicians or equivalent in research or hospital facilities. Both programs need trained professional personnel to operate the program, provide the appropriate input and interpret the results.

References

Bellina CR and Guzzardi R. CAMIRD/III: a revised version of the CAMIRD/II and MIRD-S packages for internal dose calculation: concise communication. Journal of Nuclear Medicine, Vol 21, Issue 4 379-383 1980.

Cristy M. and Eckerman K. Specific absorbed fractions of energy at various ages from internal photons sources. ORNL/TM-8381 V1-V7. Oak Ridge National Laboratory, Oak Ridge, TN; 1987.

Feller PA. Computer Software to Facilitate Absorbed Dose Calculations, , in Radiopharmaceutical Dosimetry Symposium -- Proceedings of a Conference Held at Oak Ridge, Tenn., April 26-29, 1976, ed. by R.J. Cloutier, J.L. Coffey, W.S. Snyder and E.E. Watson, pp.119-126, HEW Publication (FDA) 76-8044, June 1976.

International Commission on Radiological Protection. 1990 Recommendations of the International Commission on Radiological Protection. ICRP Publication 60, Pergamon Press, New York, 1991.

Loevinger R, Budinger T, Watson E: MIRD primer for absorbed dose calculations. Society of Nuclear Medicine; 1988.

Peterson LE and Rosenstein M. Computer program for tissue doses in diagnostic radiology. Food and Drug Administration, Center for Devices and Radiological Health, Rockville, MD 1989.

Rosenstein, M. HEW Publication FDA 76-8030, Food and Drug Administration, Rockville, Maryland. 1976.

Stabin M. MIRDOSE - the personal computer software for use in internal dose assessment in nuclear medicine. J Nucl Med, 37:538-546; 1996.

Stabin MG, da Luz CQPL. New decay data For internal and external dose assessment, Health Phys. 83(4):471-475, 2002.

Stabin MG and Siegel JA. Physical Models and Dose Factors for Use in Internal Dose Assessment. Health Physics, 85(3):294-310, 2003.

Comparison to CDI3

This program is distributed by the Food and Drug Administration through their web site www.fda.gov. It has been available since 1989 and is widely available in the radiation protection community. It has not been through a 510(k) process and does not have a document control number. It has not been classified.

Comparison	CDI3	OLINDA/EXM	Discussion
Indications for use	Estimates the absorbed doses to various tissues of a reference patient for a number of specified X-ray procedures. The program also calculates a "cancer detriment index" for the aggregate of the tissue doses.	Estimates the absorbed doses to several tissues of a reference patient for a specified radiopharmaceutical dosage.	First indication essentially equivalent. OLINDA/EXM does not calculate "cancer detriment index"
Target population	Specific patients and patient groups not targeted. Calculations are based on model of average human body "phantom".	Specific patients and patient groups not targeted. Calculations are based on models of average individuals. 10 models are available e.g. adult male, female, 5 year-old, 6-month pregnant woman.	Target population equivalent. OLINDA/EXM has a larger number of phantoms.
Design	X-ray examination input parameters are combined with previously established Monte Carlo calculations of dose per unit input to give dose estimates. Algorithm given in section 4 of "Organ doses in diagnostic radiology" (Rosenstein 1976).	User specified radiopharmaceutical kinetic parameters and previous Monte Carlo calculated organ contributions. Algorithm: MIRD system (Loevinger et al. 1988) Input: 1. Radionuclide	Different algorithms, similar inputs, same output.

	Input: 1. X-ray Spectra data 2. Exposure parameters (entrance exposure, R, source/image distance, receptor size) 3. Projection parameters Out put: Dose to organs in mrad	8. Body model 9. Radiopharmaceutical biokinetics Output: Dose to organs in mSv/MBq and rem/mCi.	
Energy used and/or delivered	The program estimates doses from user-entered criteria and precalculated data; it is not connected to an energy-emitting device.	The program estimates doses from user-entered criteria and precalculated data; it is not connected to an energy-emitting device.	Equivalent
Performance	Output of dose per unit input. DOS-based, input driven program. Fewer body phantoms. Fewer organs in output.	Output of dose per unit input. User friendly, Event driven More body phantoms More organs in output.	OLINDA/EXM is equivalent in performance to CDI3.
Human Factors	A user's manual was published by the FDA (Peterson and Rosenstein 1989). Current availability is uncertain.	Communication tools for error prevention have been systematically implemented. Error messages, help files, user manual and installation tests have all been developed so as to educate the user and prevent mistakes. An open literature publication is in preparation describing the OLINDA/EXM code. An open literature publication is available describing the MIRDOSE code (Stabin 1996), on which the OLINDA/EXM code was based.	OLINDA/EXM is equivalent to CDI3 given the current state of computer technology.
Anatomical sites	Program Tissue doses calculated: lungs, active bone marrow, ovaries, testes, thyroid, uterus, total trunk (excluding skeletal and lung tissues), and female	Tissue doses calculated: Adrenals, Brain, Gall Bladder Wall, Gall Bladder Cont, Lower Large Intestine Wall, Lower Large Intestine Cont, Small Intestine, Stomach	More tissues are included in OLINDA/EXM.

	breasts.	Wall, Stomach Cont, Upper Large Intestine Wall, Upper Large Intestine Cont, Heart Wall, Heart Cont, Kidneys, Liver, Lungs, Spleen, Pancreas, Prostate, Skeleton, Active Marrow, Skin, Thyroid, Thymus, Testes, Urin.Bl. Wall, Urin.Bl. Cont, Whole Body	
Compatibility with other devices	The only device that the program interacts with is the PC on which it is run.	The only devices that the program interacts with is the PC on which it is run and the printer associated with the PC.	Equivalent
Where used	Used by physicists to investigate new radiopharmaceuticals, and estimate patient doses. Used in universities, pharmaceutical manufacturing firms, government agencies, hospitals and research facilities.	Used by physicists to investigate new radiopharmaceuticals, and estimate patient doses. Used in universities, pharmaceutical manufacturing firms, government agencies hospitals and research facilities.	Equivalent
Standards met	None	None	Equivalent

Summary of comparison

CDI3 and OLINDA/EXM are both computer software programs that estimate the radiation dose received by tissues in average body models. OLINDA/EXM does not estimate a "cancer detriment index", as this was deemed to be outside the scope of the program's application. OLINDA/EXM does, however, calculate equivalent dose via application of radiation weighting factors currently recommended by the ICRP (ICRP 1991). These radiation weighting factors may be modified by the user if desired. Evaluation of risk is left to the user, through application of risk models. This is not treated in OLINDA/EXM in any way.

They both use Monte Carlo based calculations and require input related to the radiation delivery method. Both programs produce tables of tissue doses. The calculation undertaken is different because the radiation source is different. The utility of OLINDA/EXM is approximately equivalent to that of the CDI3 program because the calculations for both programs are based on current scientific best practice as determined by respectively the MIRD Committee (Medical Internal Radiation Dose Committee) and the FDA. The decay data and

dose factors used in the OLINDA/EXM code have been extensively peer reviewed. The decay data were published in the Health Physics Journal in 2002 (Stabin and da Luz 2002), and currently may be viewed through the Health Physics Society web site. The dose factors were then published in the Health Physics Journal in 2003 (Siegel and Stabin 2003). The phantoms on which the dose factors are based have been established previously in the literature (Cristy and Eckerman 1987, Stabin et al. 1995) and have been widely accepted and used by the international dosimetry community. Both programs are limited in that they use average body models and thus are not representative of any particular patient. OLINDA/EXM has more body models to choose from and also permits the user to vary the mass of individual organs to provide a limited measure of patient-specificity. Both programs are intended to be used by trained physicists or appropriately trained physicians or equivalent in research or hospital facilities. Both programs need trained professional personnel to operate the program, provide the appropriate input and interpret the results.

References

Cristy M. and Eckerman K. Specific absorbed fractions of energy at various ages from internal photons sources. ORNL/TM-8381 V1-V7. Oak Ridge National Laboratory, Oak Ridge, TN; 1987.

International Commission on Radiological Protection. 1990 Recommendations of the International Commission on Radiological Protection. ICRP Publication 60, Pergamon Press, New York, 1991.

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